DOCUMENT RESUME

ED 147 104 SE 023 086

AUTHOR McNown, John S.
TITLE Development of Teachers for Engineering Schools.
INSTITUTION United Nations Educational, Scientific, and Cultural Organization, Paris (France).
REPORT NO SC-TECHED-Misc-6
PUB DATE Apr 76
NOTE 11p.; Paper presented at the UNESCO International Conference for the Education and Training of Engineers and Technicians (New Delhi, India, April 20-26, 1976); Not available in hard copy due to marginal legibility of original document

EDRS PRICE MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS *Engineering Education; Faculty Recruitment; Higher Education; *Instructional Staff; *Program Development; Science Education; *Staff Improvement; *Teacher Education; Teacher Programs; Teacher Recruitment
IDENTIFIERS UNESCO

ABSTRACT

Staff development problems faced by new engineering education institutions in developing countries are examined in detail in this report. Some of the root problems of staff development identified and discussed here are: the need for planning, varied practical work experience, pedagogy, study abroad, and expatriate staff. A number of possible ways to solve these problems are suggested. Some attention to government policies, industrial cooperation, and international assistance is given. (Author/MA)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

SCOPE OF INTEREST NOTICE
The ERIC Facility has assigned this document for processing to: SE SP
In our judgement, this document is also of interest to the clearinghouses noted to the right. Indexing should reflect their special points of view.

SC/TECHED/Misc.6
PARIS, 18 March 1976
Original: English

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

Development of Teachers for Engineering Schools

John S. McNown*

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

International Conference on the Education and Training of Engineers and Technicians

New Delhi, India, 20-26 April 1976

ED147104

SUMMARY

Staff development problems faced by new engineering education institutions in developing countries are examined in detail. Some of the roots of the problems in such areas as: planning, study abroad, practical work experience, pedagogy and expatriate staff are pointed out and a number of possible ways to solve the problems are suggested.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
John S. McNown
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

* Albert O. Learner, Professor of Civil Engineering, The University of Kansas, Lawrence, Kansas 66044, U.S.A. This paper was prepared under a consultant contract with Unesco. The views expressed are those of the author and do not necessarily represent those of the Organization.

(SC-76/CONF.401/COL.7)

CS 083 086

I. INTRODUCTION

In December 1974 a group of about 20 engineering educators met in Dar es Salaam to discuss the process of preparing teachers for engineering schools. Fourteen of the participants from as many countries presented papers containing background material, case studies and proposals. Unesco had arranged the meeting as one of a series of conferences to be held in preparation for the larger meeting in New Delhi in April 1976.

The papers[1] circulated at the conference and discussions of them emphasized the special problems of developing teachers for positions at engineering schools in developing countries. The varied experiences with both problems and solutions were reviewed at length. The most important issues involved the education and early development of the young teachers. Next was the setting in which they work, including their terms of employment and opportunities for consulting and research. Their exterior environment, including the attitudes of key politicians and the technology of the country, is also important. Foresight and planning can assist both the growth of the individual and the progress of the educational programmes. Foreign academic institutions affect these developments by providing examples to be observed and centres for specialized study. Donor organizations provide funds for scholarships, assistance teams, grants and loans for a wide variety of programmes, and opportunities for the exchange of ideas.

Programmes for educating engineers in developing countries should differ among themselves and, as a group, they should depart in significant ways from programmes in countries with more sophisticated technology. Technical education everywhere is trying to adapt more effectively to economic and social needs. Many of these exert special forces within nations or regions. Accordingly, institutions must select programmes and types of assistance which are compatible with the objectives of their society.

II. PLANNING OF STAFF DEVELOPMENT

1. Need for planning

Selection and retention of qualified teaching staff are central to the realization of quality programmes in schools of engineering. The professional aspects of engineering place special requirements on the process. Both the educational institution and the individuals it employs need to lay plans and institute programmes for continuous growth and development. Unfortunately both the planning and its implementation are often haphazard. The results, in consequence, are often inadequate in important respects.

Engineering schools in developing countries have special problems. Many are newly founded, and nearly all are growing rapidly. Most have gone through or are still in periods of dependence on expatriates. The local staff are normally young and lack breadth of experience. The periods of employment for both expatriates and local staff are short. Such factors as these often combine

(1) These papers have been published in somewhat abbreviated form as Proceedings, Symposium on Staff Development in Engineering Education, Dar es Salaam, Unesco, August 1975.

with broader changes within a given country or educational institution to create a degree of instability which deters or delays effective growth. In such conditions, an established pattern for growth is essential. It must be strong enough to reassure individuals as to their prospects for advancement, and flexible enough to adjust to inevitable stress and change.

2. Individual career planning

The development of a qualified teacher of engineering is a complex process. The formative stage requires about a decade after the receipt of a first degree in engineering. During this period the prospective teacher is selected or decides for himself that he should continue his studies until he receives one or more advanced degrees. His acquisition of specialized knowledge should ideally be complemented by periods of apprenticeship in teaching, research and engineering practice. Each segment of his formation properly requires active involvement for one to several years. Subsequent career growth continues to merit some 15-20% of a teacher's career. Thus the teacher's development is an important and continuing process.

For most individuals the actual procedure is less than ideal. The decision to teach is usually made later or is contingent on the opportunity to study abroad. During post-graduate study, the student follows specialties and undertakes research projects which are more appropriate to the country in which he is studying than to his own. Upon completion of his studies, he may continue in post-doctoral research, gain practical experience in the country where he has studied or return to a teaching post at his home institution. At no point is he likely to receive more than cursory introductions to engineering practices in his country or to the body of knowledge pertaining to pedagogical processes. In these respects he differs very little from his counterparts in more developed countries. Thus teaching posts are often filled by a few engineers who are intellectually gifted but lack express preparation for teaching and practical experience.

Study abroad. Prolonged periods of study and employment abroad can disorient students from their native culture and technological environment. Students are naturally inclined to sieze whatever opportunities they are offered to extend their studies because it is easier to do so while they are already overseas than after they have returned to their homelands. The consequences of unduly prolonged stays can be detrimental, however. The acceptable opportunities at home become fewer as students specialize and mature. At some stage most students must terminate their stay abroad, and they can then be forced into employment at levels of pay and in a technology which are much lower than those they had experienced abroad. At this stage teaching may be the only opportunity which they and others view as suited to the extended preparation in formal study.

The foregoing approach to the education of teaching staff is not necessarily bad. It must work after a fashion, at least, because it occurs so often. It is, however, neither well planned for the individual nor co-ordinated with institutional planning. Surely better ways can be devised. Those who decide early that they want to teach should be encouraged to follow two strictures. First, they and their support system should arrange for their study abroad not to last longer than one to two years at a time. Second, all parties involved should work toward objectives for the educational process that are tangibly related to realistic career objectives. If a student is to accept such limited tours for study abroad, he should have some prospect of other opportunities later. To achieve this type of co-ordination, his teachers, the various institutions involved and those controlling the funds must co-operate in relating the student's complete programme to realistic career objectives.

Breadth of experience. Once the long periods of study abroad are interrupted, other parts of the development process become easier. The student with a year or two of advanced study can apply his learning either to periods of teaching or to practice. He is younger than the usual Ph.D. holder and more properly a learner or an apprentice in either activity. His special talents will emerge over a period of a few years, and he and his supervisors can decide what additional training will suit him for additional responsibility.

The Ph.D. degree should come into consideration at the next stage. It should not be, as it usually is, both the principal objective of a student who goes abroad and the primary criterion of suitability for a teaching career in engineering. It should rather be viewed as an important option for a young teacher with a talent for and an interest in research. At this stage, the student should still be encouraged to limit his stay and, to the extent feasible, to plan his research so that it relates to his home environment.

Prospective students may secure practical experience in several ways. Several years of continuous employment is undoubtedly the best way to gain such experience. Unfortunately it is also a good way for prospective teachers to be lost to the teaching profession. Career opportunities open up, the young engineer assumes a larger responsibility, his financial needs grow, and change becomes increasingly difficult.

Alternatives to the longer periods of full employment are available. Young teachers can be given work leave as well as study leave, and usually at little or no cost to the institution since they will be valuable to their employers. A year or a term on the job together with subsequent summer employment and consulting arrangements can provide experience which is less of an interruption and longer lasting. Another benefit from close but intermittent ties with industry or a government bureau is the opportunity to develop programmes of applied research. Such projects have a potential for benefits to all involved including the students who see how the knowledge they are acquiring is being applied.

Pedagogical training. Knowledge about the processes involved in teaching and learning is acquired in a variety of ways. Students observe, somewhat subjectively to be sure, the process whereby they learn. And they learn from experience. Much material has been written about pedagogical matters but little of it is immediately applicable to the needs of the beginning teacher. Unfortunately, no guide for learning to teach has received general acceptance. Perhaps in the sense intended herein, none is available. Learning is an individual and variable process, and effective teaching is a nebulous process aimed at helping students learn. Learning to teach effectively is neither an easy nor a well defined process. None the less, these very real difficulties should not obviate efforts on the part of the young teacher and of others around him to learn from the experience of others.

A first step is to provide for discussions of various aspects of the learning process. Graduate students and young teachers should listen to these discussions and contribute to them. Appropriate readings should be made available. Learning aids should be explained, evaluated and made accessible. Conferences should be held to give attention to the experiences of others. Young teachers at remote institutions should be given opportunities to participate in regional programmes organized for their benefit. That is, a young teacher should learn something about the store of knowledge, current practices and the variety of opinion on which to base his own decisions about the learning process.

To summarize, a neophyte should have a range of experience along the way to becoming a teacher of engineering. Without planning and detailed arrangement, parts of the desirable whole are often left out or inadequately treated. Teachers from the developing world usually receive a good education, both at home and abroad, but its orientation is often toward a more modern technology than that in the student's country. Probably the most important gap in the preparation, and a common one, is the lack of familiarity and experience with the local technology. Planning and sound choices could improve both the student's technological orientation and his adaptation to a teaching assignment.

3. Institutional planning

Constraints. Countries which are just creating engineering schools are usually short of local engineers. In their first decade or two their programmes are staffed mainly by expatriates as they establish procedures for developing their own teaching cadre. Most engineering schools in developing countries, new and established, experience long periods of steady growth requiring a continuing commitment to staff development. Each wishes to encourage young teachers as they develop along the lines described in the foregoing section, and each must also plan and implement procedures for creating an environment in which its teaching staff can work effectively.

The broad outlines of programmes at various places are similar, but the constraints and procedures vary with historical development, local setting, political climate and inherited customs. Many institutions reside in countries which have experienced periods of political turmoil, student strikes, financial exigencies and shortages of qualified staff. Given a degree of stability in the country, the primary factor is undoubtedly the level of financial support. The most serious problems occur when funding is insufficient to employ and retain competent people. Judicious planning is always important, but no amount of planning can make up for inadequate resources.

Varying characteristics. The variety of schools represented at the Unesco Conference in Dar es Salaam was wide indeed. The host institution has not yet graduated its first class, whereas the National Polytechnic School in Quito, Ecuador, is over 100 years old. METU in Ankara, Turkey, was founded only twenty years ago but now has an enrolment of over 4,000 in its engineering school, offers undergraduate degrees in ten different fields of engineering and has a sizeable research programme linked to post-graduate degree programmes leading to M.S. and Ph.D. degrees. Some institutions remain heavily dependent on expatriates, others almost not at all. Most of the institutions represented offer instruction in a language which is not indigenous to its country. Nearly all are or were patterned on institutions which evolved in another country with a much higher technology. Levels of technology in the countries represented ranged from very low to moderately high. Although their attitudes and programmes are inevitably quite diverse, the pooled experience highlights several significant elements.

Expatriates. Expatriate teachers have formed the impetus for the early development of many schools. The new ones in Africa south of the Sahara were originally planned, directed and staffed by English, French and Belgians. Chinese from various places have served the same rôle in parts of south-east Asia. Most schools throughout much of the third world have received assistance from individuals or teams from all parts of the developed world. METU and the Indian Institutes of Technology went through early periods of major assistance from outside. Only South American institutions developed early enough and slowly enough to be able to depend primarily on their own people. But even they have sent many of their key people to the United States of America or to Europe for a part of their education.

Expatriate assistance tends to be either monolithic, in that it comes almost entirely from one country, or mixtures of individuals and small groups from many places. Such teachers are generally foreign not just to the country but to its language, culture, politics and technology. They are usually competent in their subject and effective in the classroom. They remain in their assignments a comparatively short time, normally from one to five years, and they inevitably have commitments to a longer-term future somewhere in the developed world. They create programmes and offer courses which are patterned after those in their homelands.

Patterns and practices established by expatriates have two important characteristics. The quality of their programmes is usually good, and their adaptation to the environment in which the students will practise engineering is understandably limited. The graduates produced in such circumstances may be better fitted for work or study abroad **than** for employment within their own country. The absence of close coupling between teaching and practice is further exacerbated by the fact that most graduates go to work for a government agency which is also based on an imported and sometimes a colonial system. Thus a foreign system is created, initially staffed by foreigners and then taken over by young nationalists who have themselves been trained in the same foreign system. The evolution of an indigenous programme may take several decades unless incentives for change are produced from outside the learning system.

Expatriates coming from various countries to an institution at least raise questions about alternative procedures. Although the result can be acrimonious, the debates and necessary reflections often cause adaptations toward the local scene. If two ways are under consideration, such as those in France and in the United States, say, a third is more likely to be considered and decisions can then be made on the basis of what is better for Tunisia or Cameroon.

Despite various difficulties, expatriates have played a crucial rôle in the creation of engineering schools in developing countries. They have contributed both their ideas and their services, often with an altruistic zeal which has been directly responsible for bringing many new institutions to surprisingly high levels of accomplishment. Some have even elected to devote major portions of their careers to these new institutions. They often work under severe limitations, both professional and personal, and they must accept the fact that they are losing out in the competition for status back home. Most of them dedicate their talents to the new institution and to the development of the young nationals who will take over. And in many cases, the more successful they are, the sooner they lose the jobs they hold.

In some countries the dependence on expatriate staff has become quasi-permanent. In Zambia and Zaire, for example, engineering faculties were established at times when neither country had local engineers. Also, the systems created there were inadequately supplied with science-oriented graduates from secondary schools. With the need to replace expatriates in government bureaux and industries, the demands for nationals in some countries remain so high that few are allowed to acquire the requisite specialized training and experience for senior teaching posts. Some of the francophone countries remain heavily dependent upon a mixture of part-time teachers from expatriate firms and young volunteers who stay only a year or so. Special measures are needed if such people are to contribute effectively to a school's development.

Nationalization. In the long run all institutions will employ mainly indigenous teachers, most of whom will have followed periods of study and self-development abroad. Their development will be more or less effective from the school's viewpoint depending upon the degree to which it coincides with the institution's plans and needs. Two practices are commonly followed. In one, students study abroad with whatever resources they can find and are not linked with a teaching position until they have completed their studies. In the other, a student is identified quite early as a prospective teacher, and his stipend places him immediately on the teaching staff of the institution. He is considered as a member of staff, but is on study leave.

The former somewhat haphazard system is progressively giving way to the more controlled systems reflected by the latter as country after country finds that too few former scholarship holders and others return to take up teaching posts. Many institutions use the prospect of study abroad as an inducement for a recent graduate to work toward a career in teaching. Fellowships are then made contingent upon the student agreeing to return and spend two to four years as a teacher for each year of support during his study abroad. Such systems are effective in filling the available teaching posts, but they can be extremely binding. Academic success cannot be brought about through contract. Nor does intellectual brilliance necessarily imply an aptitude for teaching.

A good plan whereby an institution can develop young teachers should be more comprehensive. The selection process should involve a period of apprenticeship as a teacher. The course of study to be followed should fit both the individual and the programme of the school. And while some form of obligatory service in teaching may be necessary, a desire to teach is certainly more effective than a contract obliging one to do so. In the western world, periods of preparation, trial and decision for a given teacher usually last nearly ten years. In contrast, some new institutions make equivalent decisions immediately upon graduation. A period of some years of trial is surely good for all parties.

Financial support. Satisfactory terms of employment must include competitive salaries, favourable working conditions and opportunities for advancement. Without them, the competent people will leave, and the quality of the programme will drop accordingly. A certain amount of movement among university, industry and government is healthy. However, in some countries the turnover in staff is too high and too often away from teaching. In others, people are obliged and allowed to hold other positions in order to obtain incomes commensurate with their abilities. Neither practice is conducive to effective performance. A good programme nearly always costs more than a mediocre one.

Other factors which determine the quality of employment include teaching loads, supporting staff, leave policies, facilities and special prerequisites. No arbitary rules can be established for any of these important attributes of a job, but they need to be arranged so that their impact in a particular setting is favourable. For these items, also, better programmes cost more than mediocre ones. Lower teaching loads can produce better quality of instruction and more research, but they can only be arranged by adding staff. And so it is with better leave opportunities, more supporting staff and a physical environment conducive to learning.

Inadequate financial support leads inevitably to a loss of quality in the teaching programmes. The reports in the Proceedings of the meeting at Dar es Salaam exposed some of the problems that result. Positions remain unfilled,

teaching loads rise, equipment breaks down, students receive less attention, the library becomes inadequate, and on and on. In untenable circumstances effective staff development ceases although classes may continue to be held. The brightest prospects among the young nationals go elsewhere. The resulting rapid turnover, particularly of local staff, is the best indicator of inadequate support. Lack of individual growth and deterioration of the teaching programme are sure to follow. Only with a level of support which is competitive can an institution undertake an effective programme of staff development.

Other factors. Despite variations from place to place, a number of factors are important everywhere. A teacher must have an opportunity to grow along with the knowledge he is imparting. He needs time for reading, an environment suited to learning and occasional periods of freedom for concentrated study. The first two are essential to scholars everywhere. The third is particularly important to those in areas which are remote from modern technology. Fortunately, many institutions recognize the value of sabbaticals and other forms of study leave. Many provide opportunities for leave every few years with full pay. Perhaps as a consequence, programmes of study leave in Third World institutions are often more comprehensive than those found elsewhere.

Opportunities to undertake consulting and to conduct research programmes, particularly research applied to local problems, are especially important avenues of development. They serve to relate the academic world to local technology, and also to broaden the teacher's background. Such activities take valuable time, but they need not be a drain on the support of the academic programme. Advantages accrue to other agencies, and hence additional funds should be provided. The occasionalaabuses of such systems can be controlled by sound administration. Some institutions manage both consulting and research through an academic office.

Other elements which affect the quality of the academic environment depend upon local circumstances. In some settings subsidized housing is provided. Loans are sometimes made available for young staff so that they can purchase a car. Money to attend conferences or short courses is often provided. Such factors as these are used in lieu of additional salary to offset special problems in a particular setting. Their value depends upon their impact on the conditions of employment.

III. EXTERNAL FACTORS

An engineering school is part of a larger environment composed of the academic institution, the world of education, the community, the nation, and the regional technology. Each can contribute constraints, support services and opportunities. These elements of the setting for an educational programme are significant but largely beyond its control.

Academic setting. The proper place for engineering schools in higher education is a subject for much debate. As for other professional schools, some of its characteristics and objectives differ from those in the traditional areas of sciences and liberal arts. Some engineering schools are separate entities as are the Grandes Ecoles in France, METU and Institutes of Technology in India and elsewhere. Major differences arise over salary levels and criteria for employment and advancement. The competitive salary and opportunities for employment are usually better for engineers and doctors then they are for historians and geographers. Also, criteria for employment and advancement for teachers in professional fields properly include practical experience of a professional nature as well as those more directly related to teaching and research. In places where these differences are ignored, professional education often suffers.

Government policies. Governmental policies and levels of support affect the development of all tax-supported educational institutions. The Governments of India, Turkey and Singapore obviously believed in technical education of high quality and supported it. Conversely, governmental instability and changes in policy have affected adversely the growth of institutions in many places. Important changes in policy have occurred when governments rejected colonial policies, particularly those which granted educational institutions considerable autonomy. Educational institutions are dependent upon their governments for support and for a stable environment in which to work. Just as surely, governments are critically dependent upon their educational institutions for essential manpower. Each country, sooner or later, establishes its own pattern of control and support.

Industrial co-operation. Engineering schools should work closely with industries and governmental agencies who will employ their graduates. Unfortunately, however, an effective alliance is difficult to achieve. In many parts of the Third World, engineering is practised in a mixture of international corporations, government bureaus and a few local industries, usually those related to agriculture. Consequently programmes of engineering education which are prevalent in the developed world are at some variance with this range of practice. Measures to enhance co-operation are essential to the evolution of suitable programmes of study. Schools should form industrial advisory committees. Members of staff should be assigned the task of providing liaison with employers, former students, employment opportunities and other areas of mutual concern.

For reasons other than staff development, which is discussed elsewhere, teaching staff should arrange for short-term employment away from the academic setting. Conversely, engineers employed in other agencies should be used as teachers from time to time. Common problems should be attacked in concert. Isolation is often so acute in underdeveloped areas that special measures are required to combat it. Also, and for much the same reasons, the benefits of co-operation can be correspondingly greater.

International Assistance. The international world also provides ingredients which are important to staff development. Academic institutions in other countries can provide specialized educational programmes, co-operation in research, seconded staff and professional comradeship. Foreign governments and other donor agencies often provide some of the funds that make various aspects of staff development possible. The diffusiveness of the support system often makes it difficult to arrange programmes that complement effectively the home-based efforts. Frequently more flexibility and more co-operation in planning would increase the effectiveness and timeliness of technical assistance.

A successful type of education assistance is that based on links between pairs of schools. One of the pair, in a developed country, offers educational programmes, counsel, occasional staff support and assistance with research. The other, at a newer institution in a less developed country, supplies bright young students, occasional junior staff through exchange, and a part of the effort needed for co-operative research programmes. The important ingredients are co-operative planning, mutual respect and long-lasting co-operation.

Another aspect of staff development which is primarily in the province of large donor agencies is the support of conferences, exchange programmes, short courses, publications and the like. The individual staff member needs help in refreshing his knowledge and in sharing experiences with colleagues at other institutions. Examples of worthwhile programmes are regional associations of engineering education and conferences dedicated to such topics as pedagogical development, educational planning and developments in current technology. The isolation of single schools in underdeveloped areas needs to be attacked by specific programmes planned by people in these areas and tailored to their special needs.

IV. CONCLUSIONS AND RECOMMENDATIONS

1. Effective development of a teacher of engineering is a long process which contains numerous stages. Unfortunately the process is often limited to the acquisition of a research-oriented doctorate, and such important elements as practical experience and pedagogical training are frequently omitted. Both the individual and the institution should formulate plans, establish clearly the rôle the individual is to play in the school's plan and then review developments periodically for progress and possible modification.

2. Expatriate teachers usually play a dominant rôle in an institution's early years. The transition to local leadership normally occurs within a decade or two. However, limitations on high level manpower sometimes delay the transfer. Such circumstances can impede the achievement of a stable programme which is oriented to regional technology. The objectives of the expatriate teacher are sometimes difficult to match with the long-range goals of the institution. The process requires special measures which have not been well articulated.

3. Institutions must create suitable environments for their teachers if they are to have programmes of good quality. Since programmes of lesser quality are wasteful and often ineffectual, policies and financial support must provide opportunities for growth which will attract and retain talented teachers.

4. Essential components of staff development are opportunities to consult and conduct research. Suitable combinations of the two allow teachers to assist with country development. Institutional, governmental and industrial policies should encourage such activities.

5. New institutions benefit from two major sources of external assistance. Established universities in other countries receive and educate the students who are potential teachers, and they may also assist with expatriate staffing through formal or informal agreements. Donor agencies finance such programmes and provide a variety of other forms of assistance through grants and loans. The effect of such assistance is maximized if the various parties are aware of the institution's plans and are involved over a period of some years. Innovative programmes should receive encouragement and testing.

6. Programmes to produce teachers often do not include subsequent opportunities for career development. Shorter study programmes lasting from a few weeks to some months are needed to provide specialized technical education, assistance with research, pedagogical training and other opportunities for professional growth. Policies that provide support and funds are needed for leaves with pay, attendance at conferences, cost of travel and subsistence, conduct of short courses and other such programmes. These activities should have a significant place in the broader programmes of personal and institutional growth.